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United States Department of the Interior
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Fishery Leaflet 100

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Chicago 54, Ill. * November 1944

DETERMINATION OF THE AGE OF FISHES

Prepared in the Division of Fishery Biology

A study of the age and growth of fishes has become one of the indispensable tools of fishery biology and fish management. Various methods have been discovered and developed and the literature that has accumulated on various phases of the subject during the last 50 years is very voluminous.

The oldest method, known as the length-frequency or Petersen method, is fairly simple but is useful only in dealing with large populations or random samples of fishes as units. It consists of tabulating the length measurements of fish on a frequency basis and interpreting the modes in the distribution as the age-groupings of the population or sample. The method is not reliable for the obvious reasons that it cannot take into account unusual conditions of growth and will reveal no facts concerning the growth history of an individual fish. The method is used at the present time only for fishes to which none of the other methods of age determination in current use may be applied, or for a rough preliminary estimation of the age-composition or age-segregation of a sample or population.

Scales have formed the foundation of the method that is in most widespread use at the present time. The method is based on the interpretation of microscopic structures on the scale of a fish. Each scale is covered with roughly concentric lines or ridges, known as circuli. The distribution of these lines is not perfectly regular but shows breaks at various intervals. These breaks are the year marks or annuli by means of which age is determined. These year marks may be observed readily with a hand lens or a low-power microscope. Each scale contains on its surface, therefore, an indelible record of the growth history of the individual fish.

The foundation of the scale method rests upon the following fundamental facts:

1. The number of scales on the body of a fish, after all of the scales have been formed, remains constant throughout life.

2. The same scales are retained throughout life, unless lost accidentally whereupon a new scale forms. (The new or regenerated scales do not exhibit the record of growth up to the time the scale was lost, but instead have a mottled opaque area in the center. Regenerated scales cannot be used for growth study.)

3. The growth of the scale and the growth of the body of the fish are roughly proportional.

4. The rate of growth of a fish, except in tropical and subtropical latitudes, varies throughout the year. Growth is most rapid during the warm summer months and practically ceases during the winter. This seasonal variation in rate of growth is recorded in the spacing of the circuli on the scale giving rise to the bands of growth which represent each year of life.

On the basis of these fundamental postulates rather precise methods for calculating the length of the fish at the end of each year of life have been developed. Details of the method and its application to problems of fishery biology, fish management, and fish culture may be found in some of the references supplied herewith.

Certain difficulties due to the presence of accessory checks, spawning marks, or false year marks, as well as occasional abnormalities in the configuration of the scale make precise age determinations difficult at times. An inexperienced person working with fish scales should have his results checked and his conclusions verified by a trained investigator.

Some fishes do not have scales or have epidermal (ganoid or placoid) scales that do not possess the structural features of dermal (cycloid and ctenoid) scales which are employed in age and growth determinations. For such fishes the age may be determined by examining the otoliths or "ear stones" which correspond to a part of the inner ear of man and other mammals. The otolith has ridges arranged in a somewhat concentric fashion which may be interpreted in the same manner as the circuli and the year-marks or annuli of fish scales. The bones of fishes also exhibit characteristics which may be used for age determination. Cross-sections of vertebrae and bony fin rays exhibit concentric markings which have been found to correspond to the annular markings of scales and otoliths. Sometimes the age as determined from the scales is verified by examining also the otoliths and vertebrae. However, because of the distinctness of the structures of the scales in comparison with those of the bony parts of the body, scales give the most satisfactory and reliable results if they can be employed.

An experimental method of checking the reliability of the foregoing methods of age determination is by tagging and releasing fish of known age after they have been measured. The length of the recaptured fish and the time that elapsed between tagging and recapture afford not only information on growth but on migration as well.

The following list of references consists of some of the outstanding works on age and growth determination of fishes:

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NOTE: - U. S. Government publications may be consulted in many State, University, and City Libraries especially those that are Government Depositories.

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